

### REMARKS

Claims 2, 8, 10, 11, 32-38, and 71-73 are amended, claims 1, 9, and 31 are cancelled, and claims 74-110 are added; as a result, claims 2-8, 10-30, 32-40, and 71-110 are now pending in this application.

Applicant would like to bring to the Examiner's attention related application Serial No. 11/168,855 has now published as 2006/0289923 A1.

#### §112 Rejection of the Claims

Claims 12-15, 19, 20, and 72 were rejected under 35 U.S.C. § 112, first paragraph, as lacking adequate description or enablement. Applicant respectfully traverse the rejection.

The Office Action alleged

Regarding claim 12, the limitation "the first source/drain region extends horizontally around the selective epitaxy mesa" . . . is not sufficiently supported by the originally filed application. . . . The above limitation reads on the embodiment shown in Figure 4B. However, the embodiment, shown in Figure 4B has doped regions 37 formed by horizontal diffusion (see page 11, lines 21-23). Since the doped regions are formed in this manner, they cannot have a "laterally non-graded dopant profile" as required by claim 1. Therefore, the above limitation constitutes new matter. Note that claim 19 has the same problem. (emphasis original)

Applicant respectfully disagrees. Figure 4A clearly illustrates an embodiment where the doped region 37 is not formed by horizontal diffusion, as taught by Applicant on pg 11, line 10 - pg. 12 line 6. Consequently, the cited doped region illustrates a laterally non-graded dopant profile. Therefore, claims 12-15, 19, 20, and 72 do not introduce new matter. Moreover, the Office Action assertion that

Claims 12-15, 19, 20, and 72 . . . fail[ing] to comply with the written description requirement [since] [t]he claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Applicant respectfully disagrees. As noted above, the necessary written description is contained on pg. 11, line 10 - pg. 12 line 6 as well as being illustrated in Figures 5-9. Applicant believes in view of the aforementioned detailed description, claims 12-15, 19, 20, and 72 are in

compliance with 35 U.S.C. § 112. Therefore, withdrawal of the rejection of claims 12-15, 19, 20, and 72 is earnestly requested.

The Office Action also asserted with regard to claim 72,

[T]he limitation "the region of the selective epitaxy mesa adjacent to the buried conductive path comprises at least one abrupt p-n junction" is not sufficiently supported by the originally filed application. There is no disclosure of a mesa having a p-n junction. The specification describes having an undoped channel (body), meaning there would be no p-n junction between the source/drain regions and the channel. Therefore, the above limitation constitutes new matter. (emphasis original)

Applicant respectfully disagrees. Pg 5, lines 13-17 teach use of p-type dopants. For reasons of brevity and ease in understanding the inventions, Applicant indicated on Pg. 4, lines 10-13 that combinations of such teaching are possible. Therefore, one or more regions of mesa 36, including the regions denoted by Refs. 37 and 38, as well as conductive layer 33 was originally specified as being p-type in some embodiments. Applicant therefore believes claim 72 is sufficiently supported in the Detailed Description of the instant application.

#### Claim Objections

Claims 2 and 33 were objected to for informalities. Claims 2 and 33 have been amended. Withdrawal of the objection is respectfully requested.

#### §102 Rejection of the Claims

Claims 1-4, 8-11, 16-18, 24-27 and 71-73 were rejected under 35 U.S.C. § 102(b) for anticipation by Fitch et al. (U.S. 5,451,538).

Claims 1-4, 8-11, 16-18, 24-25, 72 and 73 were rejected under 35 U.S.C. § 102(b) for anticipation by Maeda et al. (U.S. 6,303,425).

Applicant respectfully traverses the above indicated §102 rejections. Fitch et al., and Maeda et al., do not teach a radial dopant profile, let alone a lateral radial dopant profile in a buried region of a mesa structure, neither document teaches a buried conductor forming a continuous conductive region enclosing the mesa, nor a semi-circular buried conductive path surrounding a mesa, as taught and claimed by Applicant.

1. *Regarding Claims 1 and 9:*

The Office Action stated

Fitch discloses . . . the selective epitaxy mesa comprises a doped region 28 being in contact with a buried conductive path 14 laterally, the doped region of the selective epitaxy mesa includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type (col. 4, lines 42-48).

Applicant respectfully disagrees. Fitch et al., only state in col. 4, lines 42-48 a conductivity type in combination with a doping method. Applicant is unable to find any teaching of a dopant profile, let alone a non-graded dopant profile in a lateral direction. The Office Action also asserted that

Region 28 can be considered in contact with conductive path 14 laterally since there is a horizontal junction between the two regions. In other words, the contact portion between the two regions extends in a lateral direction. Note that Applicant has not explicitly defined the phrase “in contact with . . . laterally” in a manner that would preclude this interpretation.

Applicant respectfully disagrees that Fitch et al., teach Applicant’s claimed doped region in contact with a buried conductor. However, claims 1 and 9 are cancelled, and therefore, the issue is moot.

The Office Action also stated with regard to Maeda et al., that

[I]n the embodiment of Fig. 33 . . . the doped region 11 will laterally contact region 31, which is in contact with region 30. Region 30 is equivalent to region 24 of Fig. 2, and both are the bit line (BL) (buried conductive path) (col. 14, lines 20-24 and col. 19, line 25). Region 31 can be considered part of the buried conductive path since it is electrically connected to the BL 30.

Applicant respectfully disagrees with the characterization. Maeda et al., state in col. 19, lines 50-54 that region 30 is an SOI layer and region 31 is a silicide formed in the bottom of a contact hole and etched so to expose SOI layer 30. Therefore, Maeda et al., clearly contemplate separate conductive regions 30 and 31, one of which supplements conduction between the conductive path 30 and the channel region *only* in the region of the hole 10.

The Office Action further stated that “region 11 (region 6a) is doped using ion-implantation and diffusion (col. 17, lines 14-20). Since the implantation/diffusion occurs in from the vertical direction, the dopant profile will not be graded in the lateral direction.” Applicant respectfully disagrees. Applicant can find no such teaching in Maeda et al. Applicant believes

no such doping grading characteristic likely exists, and therefore respectfully requests the Examiner provide a reference describing such an element. Absent a reference, it appears that the Examiner is using personal knowledge, so the Examiner is respectfully requested to submit an affidavit as required by 37 C.F.R. § 1.104(d)(2).

2. *Regarding Claims 16 and 26:*

The Office Action alleged Fitch et al., and Maeda et al., each teach substantially the same as alleged in the rejections of claims 1 and 9. Applicant respectfully disagrees for reasons noted above.

3. *Regarding Claims 2-4, 8, 10-15, 17-18, and 71-73:*

Claims 2-4, 8, and 71-73 depend either directly or indirectly from new base claim 74 and incorporate all its elements, claims 10-15 depend either directly or indirectly from new base claim 75 and incorporate all its elements, claims 17-18 depend either directly or indirectly from base claim 16 and incorporate all its elements. Since neither Fitch et al., nor Maeda et al., individually teach all elements of claims 2-4, 8, 10-15, 17-18, and 71-73, said claims are not anticipated by either applied document. Therefore, withdrawal of the rejections is earnestly requested.

§103 Rejection of the Claims

Claim 30 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Maeda et al. (U.S. 6,303,425) in view of Kurjanowicz et al. (U.S. Publication 2002/0131291).

Claims 31-40 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fitch et al. (U.S. 5,451,538) in view of Chew et al. (U.S. 6,518,622).

Claims 31-40 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Maeda et al. in view of Chew et al.

Applicant respectfully traverses the above indicated rejections. As noted, Fitch et al., and Maeda et al., do not teach a radial dopant profile, let alone a lateral radial dopant profile in a buried region of a mesa structure, neither document teaches a buried conductor forming a continuous conductive region enclosing the mesa, nor a semi-circular buried conductive path

surrounding a mesa, as taught and claimed by Applicant. Applicant is unable to find any such teachings in Chew et al., and the Office Action did not point to one. Therefore, the combination of Chew et al., Maeda et al., and Fitch et al. together does not provide the necessary teachings.

4. *Regarding Claim 30:*

Kurjanowicz et al., do not teach a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type, as taught and claimed by Applicant. Claim 30 depends directly from claim 26 and includes all its elements. Since Kurjanowicz et al., and Maeda et al., either alone or in combination, teach or suggest a laterally non-graded dopant profile, claim 30 is distinct from and non-obvious with respect to Maeda et al., and Kurjanowicz et al. Withdrawal of the rejection of claim 30 is therefore respectfully requested.

5. *Regarding Claim 31:*

The Office Action alleged "Figure 10 of Fitch discloses a vertical, selective epitaxy body . . . includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type (col. 4, lines 42-48)." Applicant respectfully disagrees. As note above, Fitch et al., only state in col. 4, lines 42-48 a conductivity type in combination with a doping method. Applicant is unable to find any teaching of a dopant profile, let alone a non-graded dopant profile in a lateral direction.

The Office Action also alleged the same as alleged in the rejection of claims 1 and 9 with regard to region 28. Applicant respectfully disagrees that Fitch et al., teach Applicant's claimed doped region in contact with a buried conductor. However, claim 31 is cancelled, and therefore, the issue is moot.

The Office Action further alleged

The difference between Fitch and the claimed invention is the intermediate region (channel region) is undoped. Figure 6 of Chew discloses a vertical access device with an undoped, epitaxial channel region 605 (col. 4, lines 30-34). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Fitch by using an undoped channel region for the purpose of simplifying the production process (by eliminating the doping step).

Applicant respectfully disagrees. Applicant believes the purpose behind use of such an undoped region is not to simplify a production process. Whether manufacturing is actually made simpler as a consequence is not relevant to any of the instant claims because Applicant is not claiming a simplified production method. Therefore, for at least this reason the issue is moot.

6. *Regarding Claim 32-40:*

Claims 32-40 depend either directly or indirectly from new claim 76 and incorporate all its elements. Therefore Applicant's claims 32-40 are distinct from and non-obvious with respect to Fitch et al., Chew et al. and Maeda et al., either applied alone or in combination for the reasons noted. Withdrawal of the rejection of claim 32-40 is therefore respectfully requested.

*Other Considerations*

The Office Action alleged

Fitch teaches region 28 is doped in-situ (col.4, lines 37-59). Therefore, the region 28 will consist essentially of dopant of one conductivity type, and will have a laterally non-graded dopant profile. It is considered in-situ doping will inherently have a laterally non-graded dopant profile. If it is not inherent, then this limitation would constitute new matter since the originally filed application does not specifically teach a laterally non-graded dopant profile. If it is inherent in Applicant's specification, then it must also be inherent in the disclosure of Fitch.

Applicant respectfully disagrees. Applicant is unable to find any such teaching in Fitch et al. Applicant is unaware of any teaching of in-situ doped material inherently having only one conductivity type or inherently having a laterally non-graded profile. Applicant believes such a dopant profile is related to in-situ process parameters, sources, dopant and non-dopant constituents in the layer, dopant concentrations, and post processing parameters. Region 28 of FIG. 4 of Fitch merely identifies layer boundaries without regard to dopant profile. Therefore, Applicant respectfully requests the Examiner provide a reference describing such an inherent feature. Absent a reference, it appears that the Examiner is using personal knowledge, so the Examiner is respectfully requested to submit an affidavit as required by 37 C.F.R. § 1.104(d)(2).

Applicant also disagrees with the assertion of the claimed profile as being new matter if not inherent. FIG. 4A clearly illustrates an embodiment where the dopant profile is abrupt.

Contrast this with FIG. 4B illustrating an embodiment where the dopant has a diffusion profile. This is further described on pg. 11, line 24 - pg. 12, line 1. Note also the distinctions between Refs. 37 and 38 of FIGs 4A and 4B. Both figures are original to the filing and may be relied on under § 608.04. Applicant provided FIGs 4A and 4B in part to make clear the distinctions in dopant profiles. Therefore, Applicant's original filing is believed to teach an abrupt doping profile and therefore, the instant claims do not introduce new matter. For at least this reason, the rejections should be withdrawn.

### **RESERVATION OF RIGHTS**

In the interest of clarity and brevity, Applicant may not have addressed every assertion made in the Office Action. Applicant's silence regarding any such assertion does not constitute any admission or acquiescence. Applicant reserves all rights not exercised in connection with this response, such as the right to challenge or rebut any tacit or explicit characterization of any reference or of any of the present claims, the right to challenge or rebut any asserted factual or legal basis of any of the rejections, the right to swear behind any cited reference such as provided under 37 C.F.R. § 1.131 or otherwise, or the right to assert co-ownership of any cited reference. Applicant does not admit that any of the cited references or any other references of record are relevant to the present claims, or that they constitute prior art. To the extent that any rejection or assertion is based upon the Examiner's personal knowledge, rather than any objective evidence of record as manifested by a cited prior art reference, Applicant timely objects to such reliance on Official Notice, and reserves all rights to request that the Examiner provide a reference or affidavit in support of such assertion, as required by MPEP § 2144.03. Applicant reserves all rights to pursue any cancelled claims in a subsequent patent application claiming the benefit of priority of the present patent application, and to request rejoinder of any withdrawn claim, as required by MPEP § 821.04.

**CONCLUSION**

Applicant respectfully submits that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 349-9587 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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21 May '07

By



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**CERTIFICATE UNDER 37 CFR 1.8:** The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Mail Stop Amendment, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 21 day of May 2007.

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